Geodyna

980L

Service Manual

HOFMANN

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CHAPTER 1
AC/DC POWER DISTRIBUTION

LOCKOUT AND/OR TAGOUT SYSTEM PROCEDURE

1. Notify all affected employees that a lockout or tagout system is going to be utilized and why. The authorized employee should know the electrical power the machine uses and it's hazards.

2. If the machine or equipment is running, shut it down by the normal stopping procedure (depress the stop button, open toggle switch, etc.)

3. Use appropriate devices to isolate the equipment from the power source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc.

4. Lockout and/or tagout the energy isolating devices with individual lock(s) or tag(s).

5. After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate. ***CAUTION: RETURN OPERATING CONTROL(S) TO "NEUTRAL" OR "OFF" POSITION AFTER THE TEST [DE-ENERGIZED STATE].***

6. The equipment is now locked out or tagged out.

ELECTRICAL REQUIREMENTS

NOTE: ANY ELECTRICAL WIRING MUST BE PERFORMED BY LICENSED PERSONNEL. ALL SERVICE MUST BE PERFORMED BY AN AUTHORIZED SERVICE TECHNICIAN.

Check on the plate of the machine that the electrical specifications of the power source are the same as that of the machine.

NOTE: THE Y2k BALANCERS PERFORM A SELF-TEST ROUTINE ON START-UP. THERE IS A DELAY OF SEVERAL SECONDS BEFORE THE DISPLAY IS ACTIVATED.

NOTE: ANY ELECTRICAL OUTLET INSTALLATION MUST BE VERIFIED BY A LICENSED ELECTRICIAN BEFORE CONNECTING THE BALANCER.

NOTE: ENSURE THAT THE OUTLET HAS AN AUTOMATIC GROUND FAULT CIRCUIT BREAKER WITH A DIFFERENTIAL CIRCUIT SET AT 30 MA.

AC THEORY OF OPERATION

WARNING!

DANGEROUS HIGH VOLTAGES ARE PRESENT IN THIS EQUIPMENT

Always use the “One Hand Rule” when working with AC voltages by keeping one hand in your pocket or behind your back. Before removing wires from the Balancer, always verify that the unit is “OFF”. Turn off the Main Power Switch on the back and unplug the AC power cord from the AC outlet.

AC DISTRIBUTION

The balancer requires 115 VAC for proper operation. The AC voltage comes in through a switch and immediately is sent to the Power Supply PCB via X41 pin 1. The drive motor is the only component that requires the 230VAC ± 10%. The primary voltage applies 230V, 60Hz AC to the BALANCER via the hot side (Black Wire) of the AC power cable. The Main Power routes to one side of the “ON/OFF” Rear Panel Power Switch. The hot wire continues to one side of the Line Filter. The neutral side routes to the other side of the Line Filter. The earth ground directly connects to the BALANCER chassis, and the Line Filter. It is critical to have the proper input voltage in order for the balancer to operate correctly.

DRIVE MOTOR

The drive motor for the unit receives AC power VIA two relays mounted directly to the Power Supply Board. To keep arcing at the relays to a minimum the relays are switched in synchronism. The switching times of the relays are determined individually and taken into consideration for optimum pull-in times. The motor also utilizes a capacitor to generate a sufficient amount of torque during acceleration and braking.

DC THEORY OF OPERATION

PROCESSOR BOARD

The operating voltage for the Main Processor is 5VDC. It receives this power from the Power Supply Board at X1 pins 32 and 34. This 5 volts also passes through the Processor Board and supplies the Encoder PCB and both the Distance and Diameter SAPE.

ENCODER BOARD

The encoder receives 5VDC from the Processor Board. This voltage can be measured at the Processor Board at X3 pin 6. The encoder is built so that there are no adjustments. The encoder disk is built onto the shaft and cannot be replaced without replacing the vibratory member. The encoder is fitted in the vibratory tube and consists of a reflective slotted sleeve which is mounted on the main shaft and the optoelectronic unit.

DISTANCE POTENTIOMETER

The distance potentiometer is a 5K pot. It is supplied 5VDC from the main processor. This input voltage can be measured at the Processor Board X6 pin 3. The output voltage is dependent upon the deflection of the guage from the home position.

DIAMETER POTENTIOMETER

The diameter potentiometer is a 5K pot. It is supplied 5VDC from the main processor. This input voltage can be measured at the Processor Board X7 pin 3. The output voltage is dependent upon the rotation of the guage from the home position.

TRANSDUCERS

The transducers are installed in a manner that it forms a virtual transducer on each end of the shaft. This configuration gives the balancer greater accuracy along with minimal amount of erroneous readings. Both measuring transducers are arranged in one plane. The tranducers produce a DC output. The DC voltage that is generated is sent back to the processor.

DISPLAY BOARD

The Display Board receives 5VDC from the Power Supply Board. This 5 volts can be checked at the harness of the display board X2 pin 6 or at the Power Supply Board X2 pin 6.

KEYPAD

The keypad allows operator input to the Main Processor Board. The output signal passes through the Power Supply Board directly to the Main Processor.

ELECTROMAGNETIC BRAKE

The Power Supply board sends 150VDC to the Electromagnetic brake on the motor stopping the tire and wheel assembly at TDC for the outside weight location. The voltage can be measured at X13 pins 7&8 on the Power Supply Board.

TROUBLESHOOTING

COMPLAINT	CORRECTIVE ACTION
I. Machine will not power up.	Is the machine plugged in at the wall? **NO->** Plug machine in. Is the balancer plugged in at the back? **NO->** Plug machine in. Are the fuse(s) inside the switch good? **NO->** Replace the fuse(s) Is 230VAC present at X41 pin 1? **NO->** Checking wiring. Is 5 VDC LED lit up on Processor Board? **NO->** Replace Processor Board. Is 5 VDC present at pins 3 and 6 at X2? **NO->** Replace Power Board. Are LED lit up on Display Board? **NO->** Reload Software Replace Display Board.
II. Machine will not brake.	Is 230 VAC present at X43 pins 2 during brake cycle? **NO->** Replace Power Board. (Retest) Replace Processor Board. (Retest) Replace the encoder. (Retest) Replace the Motor. (Retest)
III. Keypad will not function.	Use keypad schematic jumper pins of non working function. **NO->** Replace keypad. (Retest) Replace Display Board. (Retest) Replace Main Processor. (Retest)
IV. Distance gauge does not work.	Is the distance arm in the HOME position during power up? **NO->** Place it in the home position and retest. Check pins 1 and 3 at connector X6 on the Processor Board. Is the voltage reading 5 VDC +/- 1 volt? **NO->** Replace Processor Board and retest**.** Press C80 and pull the distance gauge out, does the voltage reading on the display change? **NO->** Check to make sure string is attached to distance gauge. Replace potentiometer.

Check C80 with the SAPE in the home position, is the voltage reading correct?

NO-> Readjust voltage reading to desired setting.

V. Diameter gauge does not work.

Is the diameter arm in the HOME position during power up?

NO-> Place it in the home position and retest.

Check pins 1 and 3 at connector X7 on the Processor Board. Is the voltage reading 5 VDC +/- 1 volt?

NO-> Replace Processor Board and retest**.**

Press C80 and move the SAPE gauge up, does the voltage reading on the display change?

NO-> Check to make sure the cog wheels are meshed. Replace potentiometer.

Check C80 with the SAPE in the home position, is the voltage reading correct?

NO-> Readjust voltage reading to desired setting.

VI. Machine chases weights.

Are the mounting accessories in good condition?

NO-> Clean backing plate and all accessories. Replace if necessary.

Has the balancer been calibrated?

NO-> PerformC14 and retest.
Perform C 80 and C8, and C83 and retest (Pruefrotor required).
NOTE: A FINE BALANCED TIRE AND WHEEL ASSEMBLY ALONG WITH A 3.5 OUNCE WEIGHT CAN BE SUBSTITUDED.
Perform C84 and retest (Pruefrotor required).

Check vibratory system mounting bolts, are they tight?

NO-> Tighten to specification and retest.

Check C75 ADE 1 does the left display change and then stabilize when the shaft is hit?

NO-> Replace the rear transducer.

Check C75 ADE 2 does the right display change and then stabilize when the shaft is hit?

NO-> Replace the front transducer.

Are both the Front and Rear transducers tight?

NO-> Adjust to specification and retest.

Does the shaft spin smoothly and freely?

NO-> Replace vibratory system. (Retest)

VI. Electro Brake does not work.

Check pins 7 and 8 at connector X13 on the Power Board. Is the voltage reading 150 VDC when foot pedal is pressed?

NO-> Replace Power Board and retest**.**

Check for 0.2 gap between electro switch and plate assem bly. Is the gap correct?

NO-> Adjust gap and retest.

Check voltage at Electro Magnetic switch is 150VDC present when brake pedal is pressed?

NO-> Replace Electro Magnetic switch.

PROCESSOR PCB

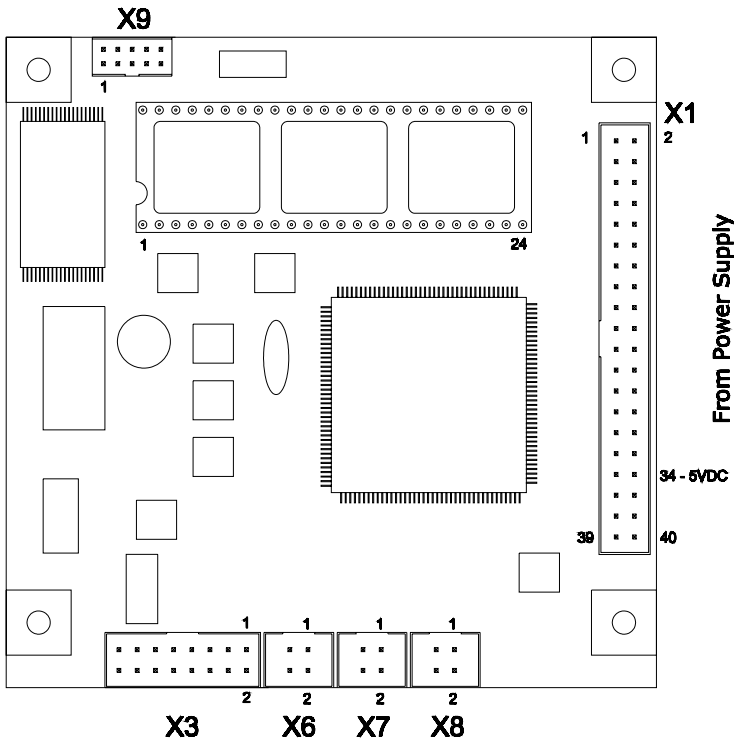
X1 - From Power Supply Board.
X3 - Encoder, Tranducers & Temp Sensor.
- Pin 6=5 VDC

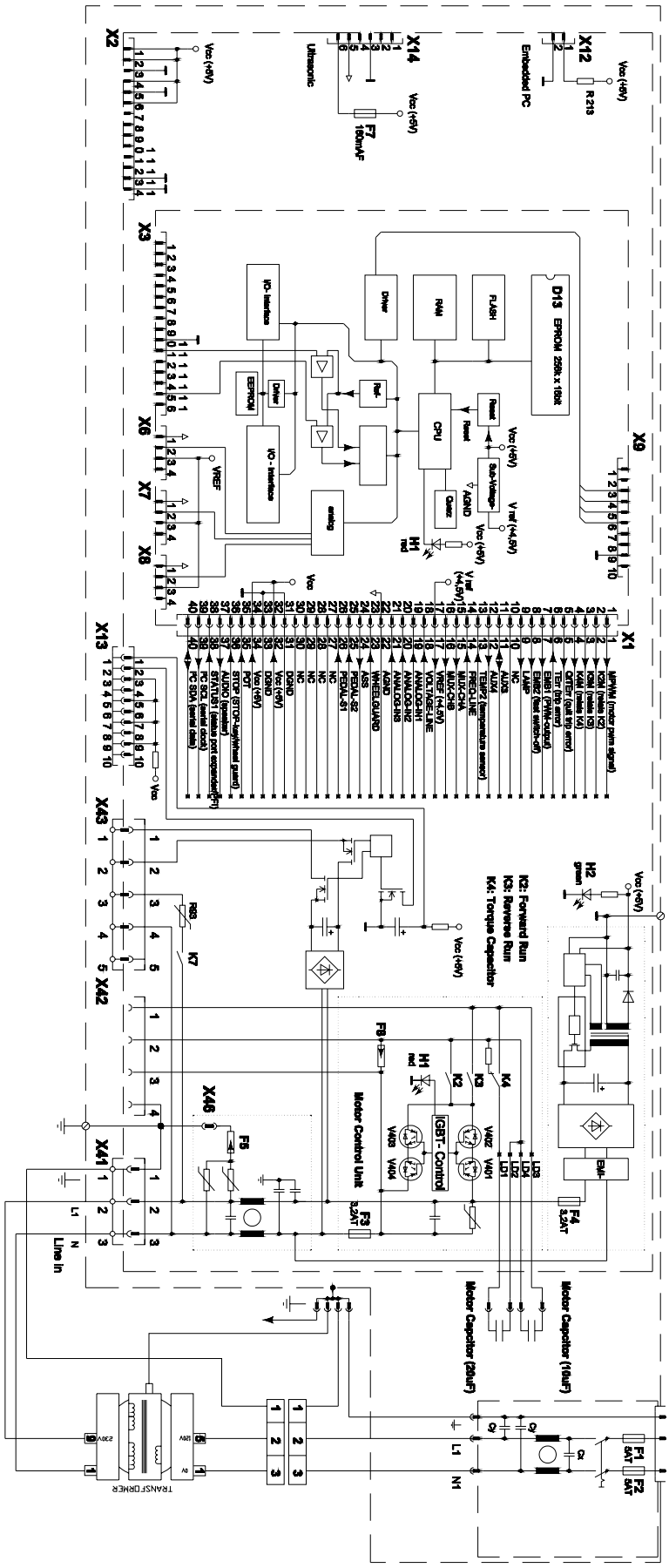
X6 - Distance SAPE
- Pin 1=Gnd
- Pin 2=Output
- Pin 3=5 VDC

X7 - Diameter SAPE
- Pin 1=Gnd
- Pin 2=Output
- Pin 3=5 VDC

X8 - Width SAPE
Not Used

X9 - Serial Connection. To COM1 on
Not Used




Power Supply Box
X1
X2
X3
X6
X7
X8
X9
X12
X13
X14
X41
X42
X43
X46
Embedded PC
Ultrasonic
Vcc (+5V)
R 213
F7 160mA/F
D13 EPROM 256k x 16bit
FLASH
RAM
Driver
I/O- Interface
EEPROM
CPU
Reset
Sub-Voltage-
Quarz
AGND
V ref (+4,5V)
H1 red
H2 green
analog
VREF
Vcc
MPWM (motor pwm signal)
KSM (relais K2)
KSM (relais K3)
KAH (relais K4)
CNTErr (cut trip error)
TEMP (trip error)
BRAKE (PWM-output)
LAMP (Not switch-off)
NC
AUX4
TEMP2 (temperature sensor)
FREQ-LINE
MUX-CHA
MUX-CHB
VREF (+4,5V)
VOLTAGE-LINE
ANALOG-IN1
ANALOG-IN2
ANALOG-IN3
AGND
PEDAL-VCC
PEDAL-S1
PEDAL-S2
PEDAL-GAIN
NC
NC
DGND
DGND
Vcc (+5V)
POT
STOP (STOP-key/wheel guard)
AUDIO (speaker)
I²C SCL (serial clock)
I²C SDA (serial data)
K1: Forward Run
K3: Reverse Run
K4: Torque Capacitor
K7
R83
F8
F5
F3 3,2AT
F4 3,2AT
F1 8AT
F2 8AT
Motor Control Unit
IGBT- Control
V402
V403
V404
V401
LD1
LD2
LD3
LD4
EMI
Motor Capacitor (20uF)
Motor Capacitor (10uF)
Line In
L1
N
N1
TRANSFORMER
230V
120V

CHAPTER 2
THEORY OF OPERATION

FUNCTIONAL DESCRIPTION

The Hofmann L980 Wheel balancer is designed to compute static and dynamic imbalance of car, light truck, heavy duty truck wheels.

Wheels are attached to the shaft using precision centering adapters and retainers. The shaft rotates on precision bearings on the shaft support. The rotating shaft is perfectly balanced. The wheels attached normally represent an imbalance, which creates centrifugal force and a dynamic momentum as it is spun on the balancer shaft. The wheel is spun by means of a low RPM motor.

The centrifugal forces created by any imbalance are detected by the two transducers located between the shaft support and the machine frame. These transducers contain small discs of special quartz which generate millivolts of electric current when compressed. The current created is linearly proportional to the compression force.

Centrifugal force vectors are generated by imbalances in the rotating wheel. This causes a signal to be generated by the transducers (which pick up only the vertical component of the constrained forces) in the form of a periodic sine wave.

The signal is not perfectly sinusoidal, due to noises from in the suspension system, which add to the signal generated by the imbalance of the wheel. To determine acutal imbalance the signal must be filtered.

To compute correct imbalance values, the parameters (diameter, width, and offset) of the wheel to be balanced must be entered. Enter wheel parameters using the Distance Entry Arm. Slide the gauge to touch the rim and hold. The distance to the rim and the wheel diameter are entered automatically by means of two mounted potentiometers. The rim width requires the use of a rim calipers and entering the measured value. This is done by pressing and releasing the rim width button and toggling the UP/DOWN arrow keys on the display panel or by rotating the tire and wheel assembly until the desired number is shown.

To find wheel imbalance, the transducers signal magnitude and encoder timing are both required. A series of timing marks on the shaft that interrupt light transmitted between two optocouplers generate a DC Square wave each time a mark moves past an optocoupler. One additional mark offset from the encoders' metallic strip, interrupts a third optocoupler on the board, creating a zero-signal reset or home position. The encoder detects 512 angular positions during each turn of the shaft, plus the home or reset position. The frequency of the DC square wave generated by the encoder allows the balancer to compute shaft speed, wheel acceleration and weight location. The encoder and transducer signals are multiplexed by the CPU to give weight amount and location readings.

The CPU board gathers the information generated from the encoder and transducer via a ribbon cable. This board is powered with 5 VDC received from the Power Supply Board.

Calculated imbalance values are then shown on the LED display panel after a spin cycle.

BALANCER COMPONENTS

MAIN PROCESSOR PCB

The microcontroller normally takes its instructions from the FLASH memory. A 40-pin IC socket is used to transfer the program from an EPROM to FLASH memory. Unlike EPROMs, FLASH memories do not require windows for UV light in order to delete data - they can be cleared and programmed electronically. Unless otherwise stated in the program revisions, new program versions can be installed without the need for adjustment. The main processor receives its power from the power supply pcb and distributes the power to the encoder, transducers and SAPE potentiometers. Calibration factors are stored in this location along with the encoder PCB.

POWER SUPPLY PCB

The Power Supply Board on a L980 receives 230VAC via power step-up transformer. The main AC power is sent to an on-board power supply which directs this power to on-board relays. This power is switched on and off via instructions from the Main Processor to spin or brake the motor. 5VDC voltage is used to power the Main Processor Board, Encoder PCB & both SAPE potentiometers.

KEYPAD

The keypad is used to input data into the Display PCB. It connects directly to the display pcb via a ribbon cable.

NOTE: ALL BUTTONS FUNCTION AS AN EMERGENCY STOP BUTTON WHEN THE MOTOR IS SPINNING

DISPLAY PCB

The Display PCB receives power directly from the power supply pcb. It passes 5VDC to power the tone generator and the LED display. It receives the information from the Main Processor Board via the power supply pcb. This information is passed back to the Main Processor routed through the Power Supply Board.

TEMPERATURE SENSOR

The system has a new force guidance structure (patent pending). The forces at the measuring transducers have been reduced, thus achieving long-term stability and high measuring accuracy. Pre-tensioning of the transducers is achieved by two leaf springs. On the vibratory system the measuring transducers are very close together so that the difference in temperature has only a slight effect. The current vibratory sensor has a temperature sensor. The transducers can therefore be measured by **one** temperature sensor and taken into account in a fraction of a second. The temperature sensor is attached to the vibratory plate by means of a U-shaped spring. This temperature sensor effects the transducers and is set during calibration.

DRIVE MOTOR

The drive unit is mounted directly to the vibratory system by means of (4) bolts. Three of the mounting holes are slotted, these are used for setting the tension on the drive belt. The drive belt is used to drive a large pulley which is mounted directly to the drive shaft of the vibratory system.

TRANSDUCERS

The transducers are installed in a manner that they form a virtual transducer on each end of the shaft. This gives the balancer greater accuracy along with minimal amount of erroneous readings. Both measuring transducers are arranged in one plane. The **rear** transducer picks up the alternating forces of the left-hand virtual measuring plane and is supported on the machine housing. The **front** measuring transducer is clamped between the vibratory tube and vibratory plate and transforms the alternating forces of the right-hand virtual plane into electrical signals.

ENCODER

The encoder disk is built onto the shaft. It cannot be adjusted and can only be replaced by replacing the vibratory member. The new incremental encoder is fitted in the vibratory tube and consists of a reflective slotted sleeve which is mounted on the main shaft and the optoelectronic unit. To prevent dirt and light entering, the opening in the vibratory tube must be sealed with black adhesive tape. A red visible LED and four light detectors are fitted in the encoder part of the optoelectronic unit behind the lenses. Part of the light is reflected back from the webs of the slotted sleeve to the encoder part and focussed by the lens, such that the web-slot pattern of the sleeve is mapped on the four light detectors. Two light detectors are connected to one amplifier in the encoder part. The difference in brightness between the detector pairs determines the instantaneous output states of channels A and B. To exclude interference from extraneous signals and to guarantee reliability the two signals are amplified by an IC. One slot in the sleeve is wider than the other 255 slots. Therefore the absolute angular position of the main shaft can be determined at constant rotating speed. The surface of the slotted sleeve must be clean and shiny, the slots must have a dull black background. Should a dirt particle have settled on a web or in a slot, it can be lifted off of the slotted sleeve with self-adhesive tape by applying it onto a strip of strong paper so that half of the tape is on the paper and the other half overhanging. **CAUTION!** If the slotted sleeve is twisted relative to the main shaft when being cleaned, the step compensation of residual shaft unbalance must be performed with F/P 84. A defective slotted sleeve cannot be replaced in the field because the ball bearings of the main shaft are pressed in. The incremental encoder can be checked with test functions F/P 36. The calibration factors are stored in this location along with the Main PCB.

VIBRATORY SYSTEM

The vibratory member is the foundation of the balancer. It houses the encoder and transducers along with a temperature sensor for the tranducers.

ELECTROMAGNETIC BRAKE

Once the balancer reaches a low RPM the Main Processor looks for the outside weight position. Once this location is known the Processor sends a command to the Power Supply Board to turn on the Electromagnetic brake. The Power Supply board sends 150VDC to the Electromagnetic brake on the motor stopping the tire and wheel assembly at TDC for the outside weight location. Once the weight is applied the operator can then press the “F” button, this sends the command to the Main Processor which in turns sends a command to the Power Supply Board to rotate the motor. The Main Processor then sends a command to the Power Supply Board to engage the Electromagnetic brake. The Power Supply Board sends 150VDC stopping the tire and wheel assembly at TDC for the inside weight location.

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CHECKOUT, CALIBRATION AND MAINTENANCE

GENERAL

This Chapter incorporates all motorized “Y2k” balancers manufactured in Conway Arkansas. The test codes for each digital display balancer are alike, and so are the results. This Chapter is written using the 3 window display results, if a two window display balancer is being serviced the display will be abbreviated from the 3 window display, keep this in mind on all results that show up in the display windows. The L980 balancer uses “C” to begin any service procedure. If a service routine is not available for any particular balancer the result will be displayed as “NOt USE”.

SHAFT IMBALANCE, WHEEL ADAPTER TO SHAFT REMOUNT TEST

This test proves the wheel balancer centering device is balanced, turns true and proves the centering device inside taper and balancer shaft outside taper (mating surfaces) are true.

1. Mount a medium size wheel assembly (14”), input the rim dimensions and balance the wheel assembly to 0.00 ounces imbalance in both planes. This must be fine balanced to exactly 0.05 in both planes.

2. Spin the balancer several times. Verify that no more than 0.05 oz. imbalance is displayed.

3. Loosen the Speed nut and rotate the tire and wheel assembly 180 degrees, making sure the cone does not rotate. ***NOTE: DO NOT REMOVE THE WHEEL ASSEMBLY.***

4. Operate the balancer. The new imbalance displayed should not exceed 0.25 oz.

   TEST PRODUCES READINGS OUT OF TOLERANCE:

5. Remove the tire and wheel assembly from the balancer.

6. Check the tapered surfaces of the basic centering device and balancer shaft. They should be clean and smooth. Clean and retest. Check all mounting accessories cones, wingnut etc. making sure each fit on the shaft snug, there should be no play between the shaft and mounting accessories.

7. If the test still produces unacceptable results use a dial indicator, measure runout of the balancer shaft tapered mounting surface. Acceptable tolerance is 0.0015" T.I.R. (Total Indicated Runout). If the surface measures out of tolerance, replace the vibratory system.

8. Perform a C80, C83, C84 and a C88 and retest. These test can be found later in this Chapter.

NOTE: A FINE BALANCED TIRE AND WHEEL ASSEMBLY ALONG WITH A 3.5 OUNCE WEIGHT CAN BE SUBSTITUTED.

BALANCER DIAGNOSTICS (TROUBLESHOOTING)

Many problems may be found by process of elimination. By determining the problem, then eliminating potential problem areas starting with the *most-likely to fail* items, solutions to problems may be rapidly found. The Y2k balancer is composed of subsystems, each requiring several inputs for proper function. With proper inputs the subsystem performs as expected and produces an output. Every piece of equipment, when operable, functions in a predetermined manner. Events have to take place in the proper sequence every time. A balancer must:

Be supplied with correct power and ground.
Give a display output.
Accept Keypad input.
Process commands through the Computer.
Receive and process encoder/transducer inputs.

Brake
Display proper weight amount and location.

The technician should watch a machine work and make performance assessments based on what is seen. If subsystem failure is suspected, use diagnostic tests to confirm the failure. Remember, every part requires input to produce the expected output. These outputs in turn become inputs for further use by the system.

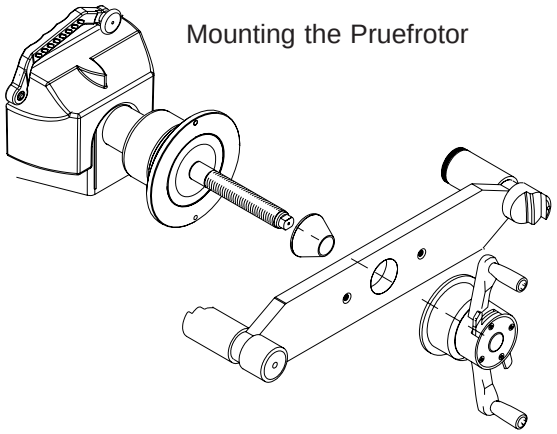
TROUBLESHOOT USING CORRECT DIAGNOSTICS PROCEDURES

Balancers are relatively simple pieces of machinery. With proper diagnostic procedures, balancer problems should be quickly resolved. The Basics that the technician must *never* overlook are:

1. AC Power. The unit must be supplied with correct AC power.
2. Ground. These machines depend on proper Grounding for proper and safe function. Improper or poor ground will create problems that are quite difficult to diagnose, *and may create a dangerous condition*. Check, never *assume* ground is correct!
3. DC Power. The microprocessor will not run correctly (if at all) if it is not supplied with proper DC power and ground. Check DC power for ripple or drift (may indicate faulty regulation or failing PCB's). Ensure there is *enough* power and a good ground.
4. Inputs. Check for proper Encoder and Transducer signals.
5. Output - Once all voltages and signal levels are present a proper output can be expected.

TOOLS REQUIRED WHEN SERVICING THE BALANCER

Tools
Metric Sockets (4mm Thru 15mm)
Metric Wrenches (6mm Thru 15mm)
Assorted Hex Wrenches metric / standard
Inch Pound Torque Wrench
Foot Pound Torque Wrench
#2 Phillips Screwdriver
#2 Flat Head Screwdriver
Digital Volt-ohm Meter
Small Screwdriver
Hilti Rotor hammer drill (Installation Option)
Pruefrotor (H6416946) or fine balanced tire/wheel assembly.
3.50 ounce (100gr) wheel weight
Program EPROM
Loctite #242 and #272 or #609
Silicone based grease - Used for transducer ball placement
Putty for fine wheel balancing.
1, 2 and 3 ounce weights verified accurate (weigh on postal scales and trim to exact weight - paint and label)


Mounting the Pruefrotor

A test tire and wheel balanced to within 0.10 oz. (2.8 gr.) on both inside and outside planes or 0.20 oz. statically (mode 7) i required during some troubleshooting procedures.

In the event of vibratory system replacement, the use of a certified Pruefrotor will be required to confirm conformance to design specifications and certification requirements.

SERVICE FUNCTIONS OF HOFMANN BALANCER

The C-codes decribed in this manual are “Service Codes”, see the Operator Manual for any special related operator code.

Grams / Ounces - C-Codes

Weight Placement Mode

All the service codes are entered using C codes. The procedure for activating an C code is described below.

1. Press the 

(C-Code) key and the  (weight placement) key at the same time.

2. Use the  and  keys to increase or decrease the number in the RH display until the desired C code is displayed.

3. Press the 

(C-Code) key once the desired code is displayed to activate.

SERVICE CODES

28 Check last 10 kernel error messages & Clean all recorded error codes.
43 Read or reset re-setable counter.
44 Read or reset productivity of user. Display counter number of default user only.
50 Read output voltage of potentiometer of distance measurement of SAPE.
51 Read output voltage of potentiometer of the diameter measurement of the SAPE.
52 Read output voltage of potentiometer of the width measurement of the SAPE.
53 Display test
55 Check AC and DC voltages
60 Read shaft speed RPM.
75 Use ADE 1&2 to check transducer output.
80 Calibration of SAPE
81 Calibration of Flange Zero
83 Manufacture calibration (Pruefrotor required).
84 Empty Calibration of the bare shaft.
85 Copy contents of Processor to Encoder, only available in initialization.
86 Copy contents of Encoder to Processor, only available in initialization.
88 Top Dead Center calibration (TDC)
90 Saving Calibration Data.
92 Split weight mode.
110 Displays 5Volt power.

C CODE DESCRIPTIONS OF THE BALANCER

C 28 KERNEL ERROR MESSAGES

Enter C 28 the machine. Press the ± key until 1 is displayed, the error for that spot is displayed. Continue to press the ± key to toggle through all recorded error codes up to 10.

C 43 RESETTING THE COUNTERS

The counter can be reset using this code:

Enter C43 and press the ± key until "1" is displayed. Press the "C-Code" button to reset the counters to zero.

C47 SELECT MACHINE MODEL

This balancer is sold world wide under different brands and model numbers. To validate any software upgrades. Enter C47, press the ± until 980Lu is displayed, press the C-Code key to select the model.

C 53 DISPLAY TEST

Used to diagnose the display panel. Once activated the display will either scroll a message or all LED's will light up. Pressing **<STOP>** displays cancels this test.

C 55 CHECK AC AND DC VOLTAGES

Example: "AC 230" and "dc 5.15". Although some machines require only 120VAC the machine still displays AC 230 volts, the step up transformer generates 230VAC on these units. Press STOP button to exit this function.

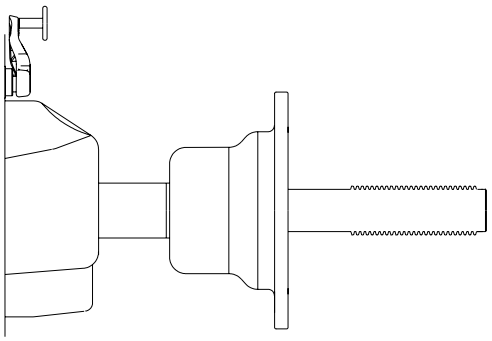
C 60 READ SHAFT RPM

This test displays the motor RPM, a reading of 100 RPM's +/- 10. Press **"STOP"** to exit this function.

C 80 SAPE GAUGE CALIBRATION

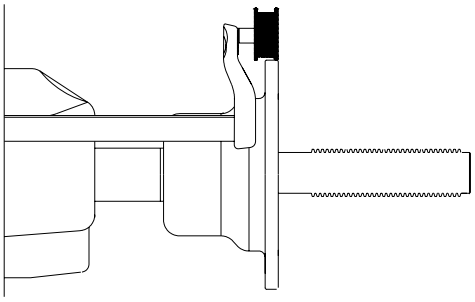
To calibrate the SAPE gauge.

1. Move gauge arm to calibration position 1 (home position) and adjust the distance potentiometer. The voltage reading in the right hand display should read +4.25 - +4.30VDC.



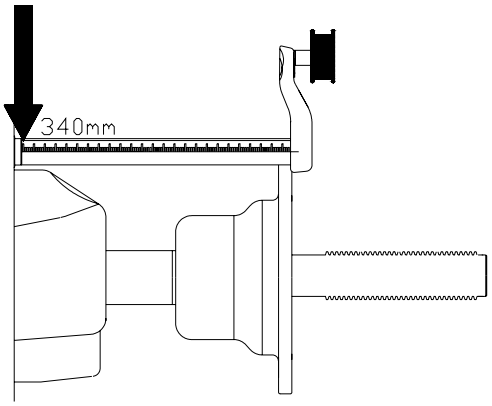
2. Place the tip of the guage assembly on the bell housing and adjust the diameter home reference potentiometer. The voltage reading in the left hand display should read +3.55 - +3.60VDC.

   PRESS THE "C-Code" button to confirm readings.



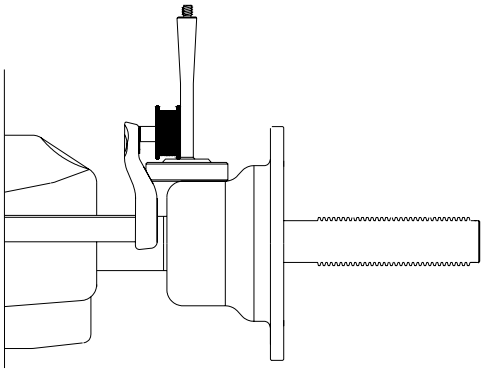
3. Pull the guage are out 340mm.

   PRESS THE "C-Code" button to confirm readings.



4. Put the flat side of the calibration weight on the flange and move the gauge arm until it reaches the side of the calibration weight ; hold this position.

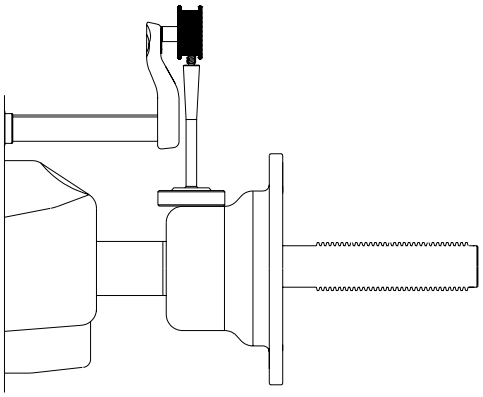
   PRESS THE "C-Code" button to confirm readings.



5. Put the flat side of the calibration weight on the flange and move the gauge arm until it reaches the upper tip of the calibration weight hold this position.

   PRESS THE "C-Code" button to confirm readings.

   USE <C90> TO SAVE DATA



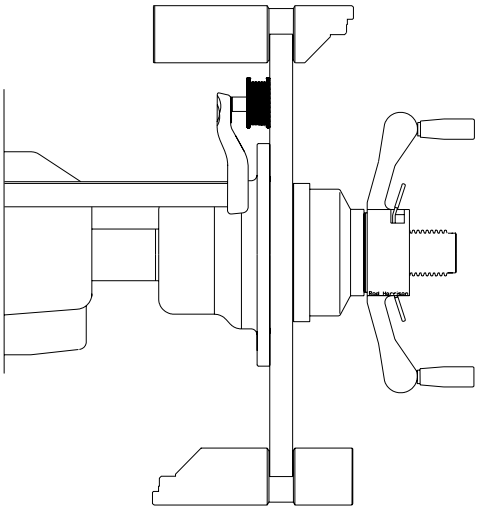
C 81 MEASURE ZERO PLANE OF ADAPTER PLATE

1. Mount the Pruefrotor on the shaft using the proper mounting adapters.

2. Move the SAPE gauge arm until it reaches the left side of the test rotor and hold this position.

   PRESS THE "C-Code" button to confirm readings.

   USE <C90> TO SAVE DATA

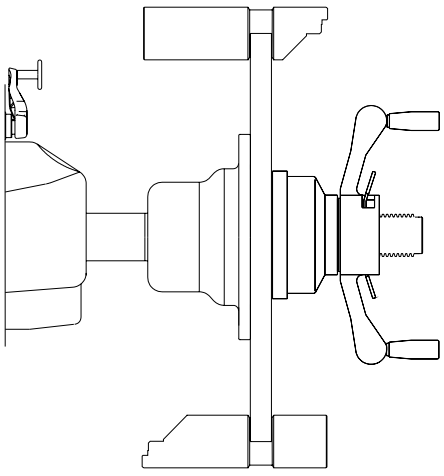


C 83 FACTORY CALIBRATION PROCEDURE

NOTE: THE C80 CALIBRATION MUST BE DONE BEFORE THIS OPERATION.

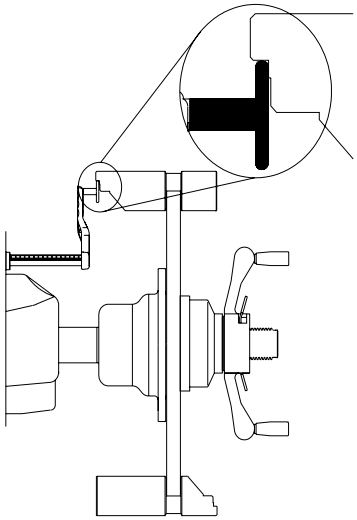
Beginning with a Pruefrotor

1. Mount the Pruefrotor on the balancer shaft.



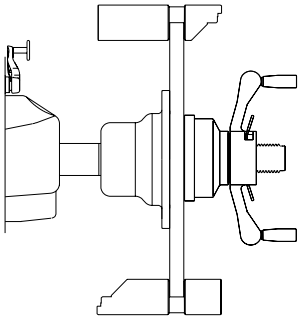
2. Pull the distance gauge arm out and touch the Pruefrotor.

3. Return the Distance Gauge to the home position. The distance and diameter (15.0) is auto measured. Manually enter the width

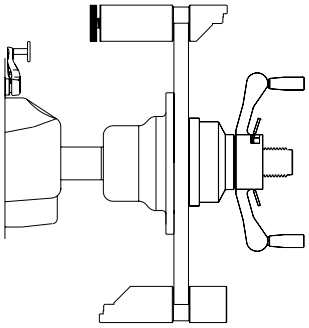


4. Enter **"C 83"** and start the first measuring run.

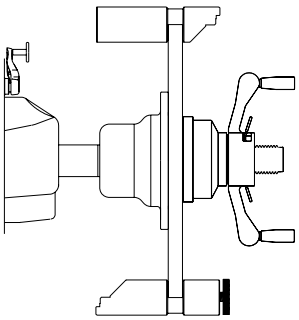
5. After the balancer stops spinning press the "C-Code" button to accept the 100g weight (3.5oz).



6. Attach the 100g weight (3.5oz) on the inside of the Pruefrotor and press the start key to start the second measuring run.

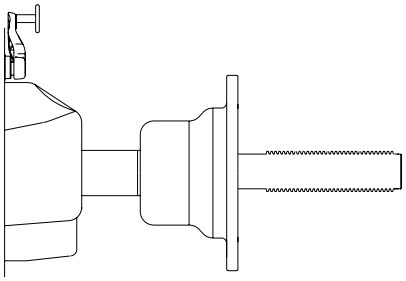


7. Attach the 100g weight (3.5oz) on the outside of the Pruefrotor and press the start button to start the measuring run.



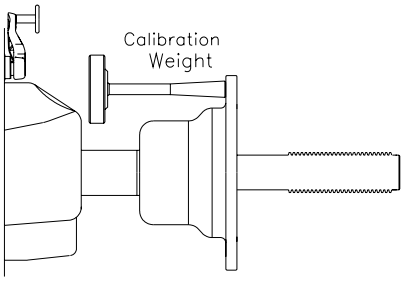
8. Unclamp the Pruefrotor and press the “C-Code” button. The machine will automatically measure the temperature.

10. Spin the empty shaft by lowering the hood or pressing the start key.



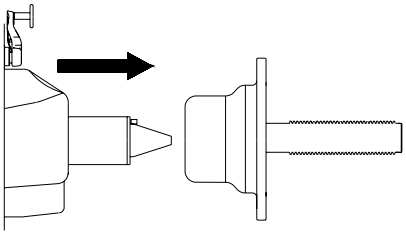
11. Install the calibration slug on the left side of the bell housing and start the measuring run.

CALIBRATION COMPLETE USE <C90> TO SAVE DATA



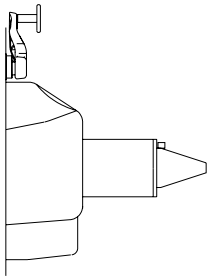
C 84 EMPTY SHAFT CALIBRATION PROCEDURE

1. Using the hex key supplied with the machine remove the flange adapter.



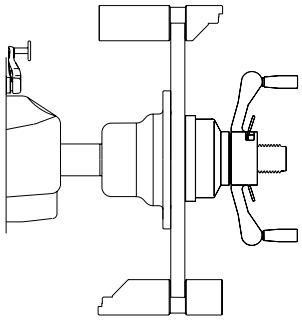
2. Spin the empty shaft by pressing the **<START>** button.

CALIBRATION COMPLETE USE <C90> TO SAVE DATA

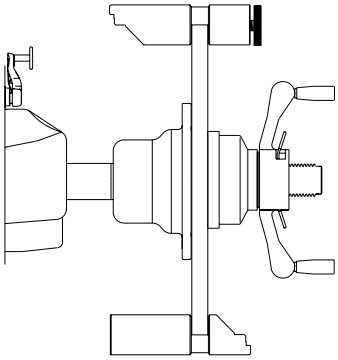


C 88 CALIBRATE TDC

1. Reattach the flange adapter and mount the Pruefrotor. Press the <START> button to begin the first measuring run.



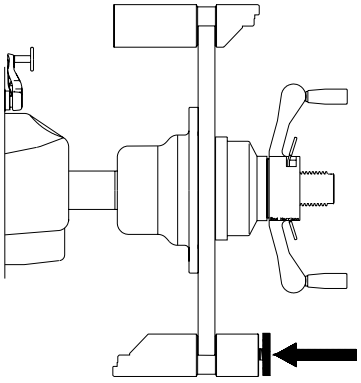
2. Attach the 100g weight (3.5oz) to the outside plane and press the **<START>** button to begin the measuring run.



3. Rotate the 100g weight to the bottom, it may be necessary to use a torpedo level to adjust the Pruefrotor in the verticle position.

   PRESS THE "C-Code" button to confirm readings.

   USE <C90> TO SAVE DATA



C 85 COPY CONTENTS OF MAIN PCB TO ENCODER

When an Encoder PCB is replaced and on initial power up the unit will display "C 85". The technician needs to simply press the **<C>** key to transfer the calibration factors from the Main PCB over to the new Encoder. To change the display from 85 to 86 simply press the **<UP ARROW>**.

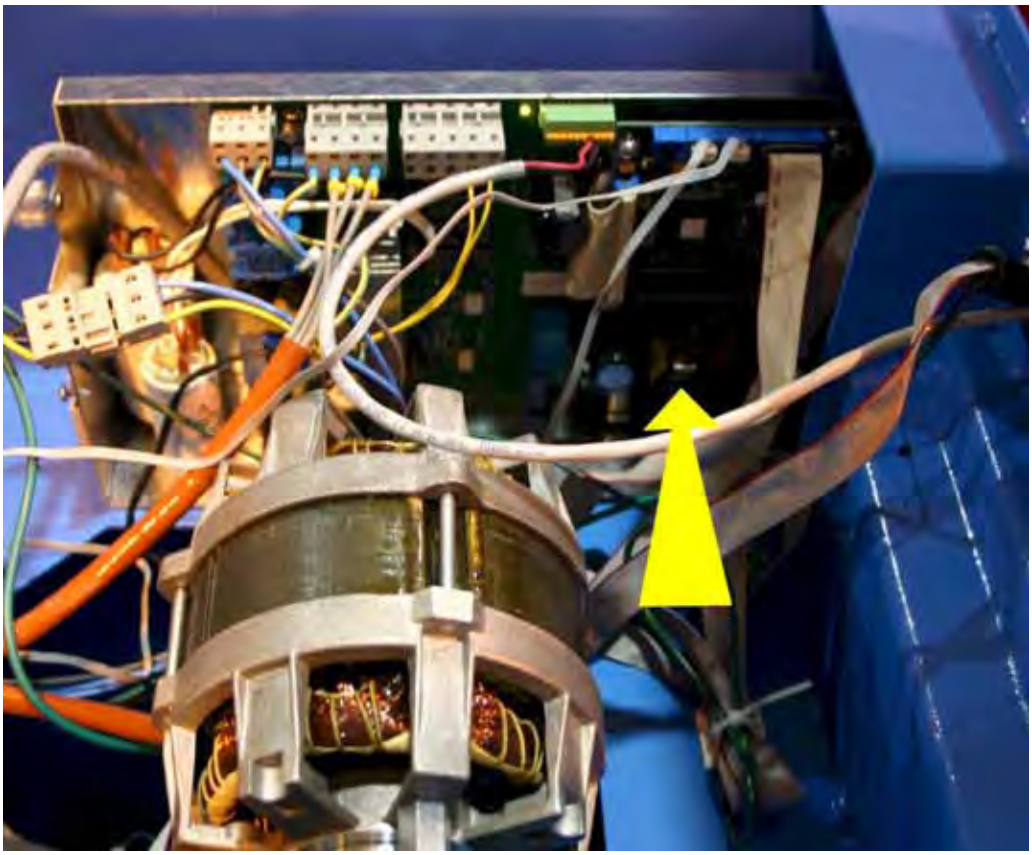
C 86 COPY CONTENTS OF ENCODER TO MAIN PCB

When an Main PCB is replaced and on initial power up the unit will display "C 85". To change the display from 85 to 86 simply press the **<UP ARROW>**.86 . Simply press the **<C>** key to transfer the calibration contents from the Encoder to the Main PCB.

C110 VCC VOLTAGE

The operating voltage of the processor is +5.23 VDC ± .25 volts. If the voltage is out of range the balancer may experience a reset problem or it may display 81118b indicating that the voltage is to high or 81018b indicating that the voltage is below the acceptable range. A small adjustment on the balancer power supply can be made. Follow the procedure below to bring the voltage within the acceptable range. Repairs must be made before attempting the voltage adjustment below.

1. Remove the weight tray.
2. Remove the cover from the power supply.
3. Power up the unit.
4. Enter the service menu and press <C110>.
5. Using a tweaker tool, adjust the voltage between +5.20 and +5.26 VDC.



WARNING!

DANGEROUS HIGH VOLTAGES ARE PRESENT IN THIS EQUIPMENT

SERVICING THE BALANCER

NOTE: BEFORE OPENING THE MACHINE FOR SERVICE, DISCONNECT ELECTRICAL SUPPLY LINE AND USE THE LOCKOUT / TAGOUT PROCEDURE.

The balancer is supplied with 110/230 VAC . It is critical to have the proper input voltage in order for the balancer to operate correctly. The balancer performs a systems check on initial power up. If a problem is detected the balancer will emit random beeps.

To check power cable:

- Disconnect the power supply from the balancer.
- Using a VOM, check for an output voltage at the end of the power plug 110VAC ± 10%

To check power to power supply box:

- Remove the weight tray.
- Using a VOM check for 230VAC at the power supply board, X41 pins 2&3 all balancers.

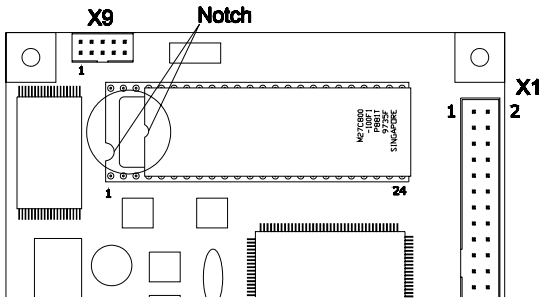
MAIN PROCESSOR REPLACEMENT

⚠ WARNING!

USE STANDARD ANT-STATIC PROCEDURES WHILE PERFORMING THESE INSTRUCTIONS

1. Disconnect the power from the unit.
2. Locate the Main Processor PCB, in the Power Supply Box on the motorized balancer.
3. Insert the program EEPROM in the socket on the processor board.

   NOTE: THE NOTCH ON THE END FACE OF THE EPROM MUST POINT TOWARDS THE NOTCH ON THE SOCKET OF THE PCB.



4. Plug the power cable into the balancer and switch the balancer to the on position. The balancer will emit three beeps. The upload will take approximately 45 seconds. After the completion of the upload the balancer will continuously emit beeps.

   CAUTION!: DO NOT REMOVE POWER FROM THE UNIT DURING THE UPLOAD PROCESS, PERMANENT DAMAGE TO THE MAIN PCB WILL OCCUR.

5. When the upload is complete remove power from the balancer. Remove the EPROM off of the socket using a screwdriver, and place it in packaging for transport. Reassemble the balancer and apply power.

TO ACCESS THE INSIDE OF THE MACHINE

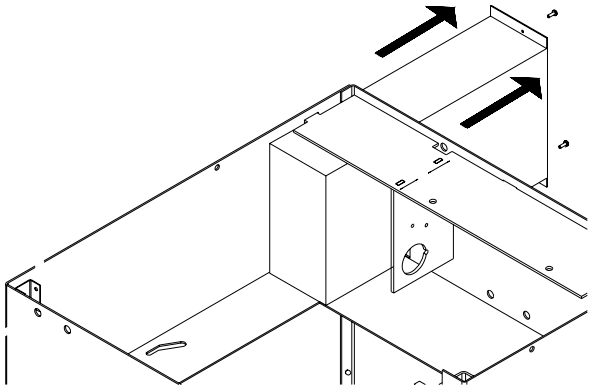
1. Remove the screws from the front and rear of the weight tray.

2. Standing at the front of the machine, rotate the SAPE arm to it's full most outward position. Lift and remove the weight tray. Avoid breaking or damaging wire harnesses. Harnesses may be held in place with various retainer clips.

   NOTE: WHEN INSTALLING THE WEIGHT TRAY, BE CAREFUL NOT TO CRUSH WIRES.

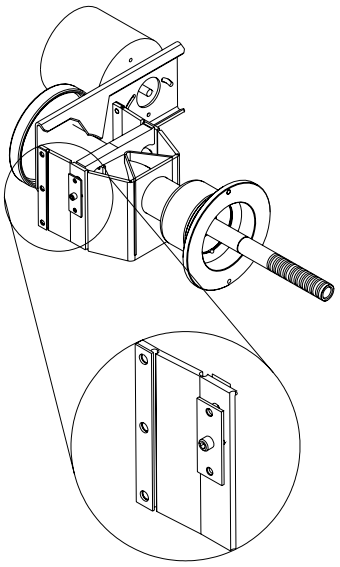
POWER SUPPLY BOX

- Disconnect the power from the rear of the machine.
- Remove the weight tray.
- From the rear of the machine remove the two screws holding the Power Supply box.
- Gently pull the box out the back paying special attention to the wiring harness that are connected.
- Un-plug each of the harnesses from the power supply box marking each harness to ensure correct installation.



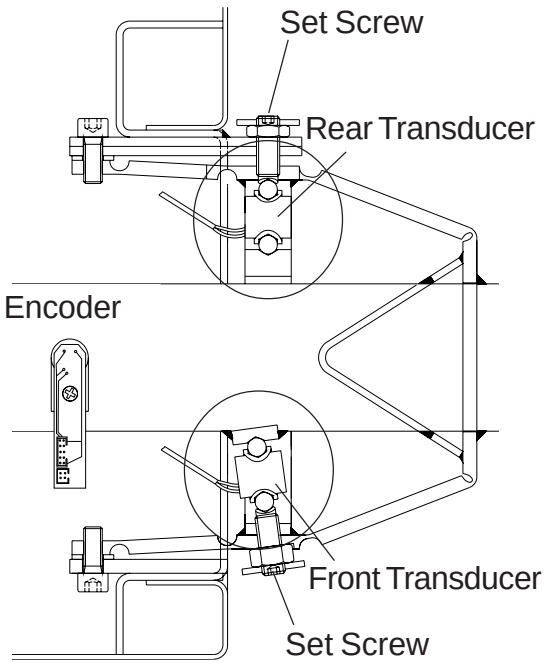
TRANSDUCER REMOVAL

- The transducers are held in place with setscrews and jam nuts.
- Disconnect the power from the rear of the machine.
- Remove the display panel.
- Remove the weight tray.
- Using a 2.5mm hex key remove the preload plate.
- Using a 13mm wrench loosen the jam nut.
- Using a 5mm hex key, back the set screw off by turning counterclockwise. (Figure 3-27) Do not lose the ball bearings on each end of the tranducers. These allow the transducer to center easily on the vibratory member.
- If the transducer is being replaced using a marker mark the front and rear transducer harnesses. Cut the two wires at the transducer. The positive lead of the harness is marked with a black band. (When using a harness and transducer assembly, this step is unnecessary.)



INSTALLATION OF TRANSDUCER

- The front and rear transducer must be installed correctly in order for the balancer to function correctly. The rear transducer uses the last 2 wires pins 15-16 in the harness.
- Connect the positive and negative lead to the transducer. The positive lead is marked with a black band.
- Insert the clip into the transducer firmly snapping it into place. Once the wire is installed it cannot be removed without destroying the transducer.
- Apply a small amount of grease to each end of the transducer. Place the ball bearings in place on the transducer. Place the transducer assembly in the vibratory system.
- Finger tighten the set screw to position the transducer. The wire connection should be on the bottom. A properly installed transducer will be able to rotate freely but must have ***no*** side to side motion.
- Snug the jam nut that holds the setscrew. This nut should be tightened solidly, but need not be extremely tight. Recheck the transducer to ensure that no lateral movement exists after tightening the jam nut. Adjust as necessary.
- Hold the pre-load plate in position up to the jam nut and

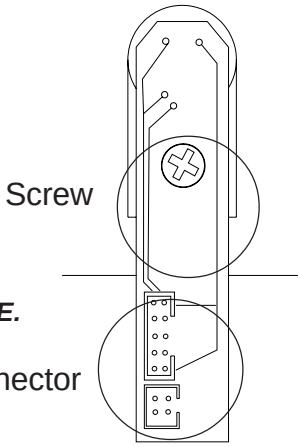


finger tighten the set screws to just hold
the plate in place without movement. Tighten the upper screw ½ turn, then tighten the lower screw one full turn, then tighten the upper screw an additional ½ turn.

- Reassemble the complete balancer and perform a complete factory calibration to ensure proper operation.

NOTE: MOVING THE TRANSDUCER AFTER CALIBRATION WILL CHANGE THE ACCURACY AND REQUIRE FACTORY CALIBRATION

ENCODER REMOVAL



- Disconnect power.
- Remove weight tray.
- Disconnect the 10 Pin ribbon cable from the encoder PCB.
- Remove the phillip screw holding the encoder PCB to the shaft tube.

NOTE: BE CAREFUL NOT TO LET FOREIGN DEBRIS FALL INSIDE THE TUBE.

VIBRATORY MEMBER REMOVAL

- Disconnect the power from the rear of the machine.
- Remove the weight tray.
- Disconnect the mechanical brake at the vibratory system.
- Disconnect the motor and encoder harness from the Power Supply box.
- Remove the rear transducer.
- Remove the access plugs from the front of the balancer.
- Using 1/4" drive 6mm hex head SOT part # TMAM6E remove the six (6mm) hex bolts to the vibratory. Pay special attention of spacer placement.
- Lift up on the vibratory member and remove.

VIBRATORY INSTALLATION

- Lift and set vibratory member into the balancer housing.
- Insert spacers.
- Apply Loctite 242 to the hex bolts.
- With the aid of a helper start the two lower hex bolts.
- Install the 4 remaining hex bolts and tighten to 22ft. lbs. +/- 3 in. lbs.
- Install the rear transducer and follow transducer installation.
- Install mechanical brake and follow mechanical brake installation.
- Install weight tray.
- Connect power and follow all calibration procedures **C 83, C84**, **C88** and test.

USE OF A PRUEFROTOR MUST BE USED TO MAINTAIN ISO 9000 STANDARDS.

MOTOR REMOVAL

- Disconnect the power from the rear of the machine.
- Remove the weight tray.
- Disconnect the Motor wiring harness from the Power Supply box.
- Remove the setscrew securing the motor pulley to the motor.
- Remove the (4) bolts securing the motor from the vibratory system.
- Reverse procedure for installation.
- Using a pry bar, pry against the motor spacers to tighten belt.

HOOD SWITCH / CAM / SPRING

- Disconnect the power from the rear of the machine.
- Remove the weight tray.
- Disconnect the Hood Switch from the Power Supply Board and remove the wiring from the connector.
- Remove the two (2) screws holding the switch to the mounting bracket.
- Remove the set screw holding the cam to the hood shaft and slide the cam off of the shaft.

NOTE: THE HOOD SPRING IS UNDER PRESSURE. TO RELEASE PRESSURE RAISE THE HOOD TO THE OPEN POSITION.

- Remove the screw from the shaft that attaches the hood spring.
- Reverse procedures for installation.

APPENDIX A
CODES

KERNEL CODES

A complete error code consists of 6 hexadecimal digits.

Prefix	Digit 6	Digit 5	Digit 4	Digit 3	Digit 2	Digit 1
0X	Module ID		Priority ID	Error ID		
Digital Display	Left Display			Right Display		

Module ID: 2-digit hexadecimal value and indicates the software module which detected the error.
Priority ID: Represents the kind of error (message only, critical error).
Error ID: Determines the kind of the fault.

Module ID	Description
21	Time Service
22	I2C bus device driver
23	Serial device driver
24	Sound device driver
25	External AD converter
26	Internal AD converter
27	Temperature measurement
28	Piezo transducer
29	Incremental encoder Main shaft
2A	Incremental encoder belt disc
2B	Relay management
2C	Hand-spin brake
2D	Electromagnetic brake
2E	main supply line
2F	motor
30	Supervisor
31	Watchdog timer
41	Auto stop system
42	Data conditioning
43	Rim data management
44	Sape device
45	Display device
46	Keyboard device
47	Brake device
48	Motor device
49	Drive (Motor & Brake)
4A	Power clamp
4B	Incremental potentiometer
4c	Rim light
61	Balancing algorithm
62	Balancing calibration
63	Behind the spokes placement
64	<not used>
65	Optimisation
66	Measurement control

81	Command language (Commands coming from the UI)
82	Calculator
83	Message Server (Message service from BK to UI)
84	Message Server (User messages from BK to UI)
85	Sleep command
86	Balancing Kernel : Test statemachine (eg selftest during startup)
A1	Event system
A2	User management
A3	State machine
A4	complex data type
A5	Persistent objects
A6	Pipe device
A7	Power on time counter (-> time stamp for error recording)
A8	Counter for total spins / in service-, in user mode
C1	Self test
C2	User interface
C3	User interface

Priority ID	Description
0	Critical error (will be recorded in user mode)
1	Warning message
2	For information only
3	All of above, but will not be recorded in the error record (persistent objects p30 to p39)

Error ID	Limits	Description
F01		Not complete
F02		Invalid job
		Mod 2D, Brake : Module gets invalid event.
		Mod 49, Drive system : Internal error, command not valid in actual mode of operation
		Mod 66, Meas Control : Internal error. Module gets invalid user event. command not valid in actual mode of operation
		Mod C1, Self-test : Self-test failed, see error record for more information (kernel register err0,...err9 or User interface: C28).
F03		Out of memory
F04		Out of range Mod 27, Temperature: Out of Range
F05		Buffer full
F06		Channel not found
F07		Not found
		Mod 41, ASS : Time client not found
		Mod 44, SAPE : Time service not found during unregister
		Mod C1, Self-test : Self-test failed, result of test invalid
F08		Already exists
F09		In use
		Mod 44, SAPE : AWP already in use
		Mod 49, Drive system : Internal error, command not valid in actual mode of operation
		Many “490F09” errors in the error record indicates a malfunction of the pedal.
F0A		End of file
F0B		Drive full

Error ID	Limits	Description
F0C		Bad name
F0D		Xmit error
		Mod C3, User Interface : **Communication Error between balancing kernel and user interface (BK <- UI). Machine should be restarted.**
		This error can be caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F0E		Format failed
F0F		Bad parameter
		Mod 41, ASS : Invalid time specified
		Mod 44, SAPE : Bad parameter during calling time service
		Mod 81, cmd : Parameter of a kernel command is bad. Such an error can occur as a result from a hardware malfunction.
F10		Bad medium
F11		Error in expression
		Mod C3, User Interface : **Communication Error between balancing kernel and user interface (BK -> UI). This error can be cleared by pressing STOP or Escape.**
		This error can caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F12		Overflow
		Mod 41, ASS : Too many time clients
		Mod 44, SAPE : Overflow (e.g. invalid time period)
F13		Not implemented
F14		Read only
F15		Bad line
F16		Bad data type
F17		Not running (still not initialised)
		This error can occur after a measuring run, if the incremental encoder of the power clamp is not able to detect the reference mark (810F17). check the incremental encoders with C54, C74 (main shaft) and C98 (power clamp)
F18		Timeout
		Mod 31, Watchdog: Recorded during start-up: Watchdog causes last reset. Check error record (C28).
		Mod 42, Data cond. : Can't get data from external AD converter This error can caused by a malfunction of the incremental encoder. Check C74 and C54. A malfunction of the micro-controller board Check C75 if ADE1 and ADE2 displays valid results.
		Mod 44, SAPE : Communication timeout (No answer from AWP)
		Mod C1, Self-test : Self-test failed, test function does not response (timed out)
F20		Access denied
		Mod 49, Drive system : Access denied : e.g. Use of the clamp device if it is not available (not a power clamp machine?) - Requested action not allowed
50		UT_CMPLX_ERROR_MatrixSingular
60		ERR_VOLTAGE_ZERO
61		ERR_VOLTAGE_BELOW_LIMIT
63		ERR_VOLTAGE_ABOVE_LIMIT
64		ERR_VOLTAGE_really_HIGH
100		Keyboard : No time client available

Error ID	Limits	Description
101		ERROR_KEYB_NO_HARDWARE_AVAILABLE
102		ERROR_KEYB_ORDER_BUSY
120		Display (Digital) : No Hardware available
130		Bad parameter for the frequency of beep command
131		Bad parameter for the volume of beep command
132		Bad parameter for the sound file of beep command
133		Bad parameter for the repetition of a beep
134		Sound file corrupted
140		RS232-E : Wrong parameter for ioctl call.
141		RS232-E : Input buffer overrun occurred
142		RS232-E : Transmission error
143		FIFO_KORRUPT
144		FIFO_WRONG_ACTION
145		FIFO_EMPTY_READ
146		FIFO_FULL_WRITE
147		FIFO_STRING_ENDE
148		PIPE_NO_COMPLETE_MESSAGE_AVAILABLE
149		SER_WRONG_ACTION
14A		SER_NO_HARDWARE
14B		SER_ERR_RESET_FIFO
14C		SER_ERRORCODE_EXISTS
160		ERROR_PO_INIT_READORDER_FAILED
161		ERROR_PO_INCORRECT_DATA_OR_HEADER_SIZE
162		ERROR_PO_EEPROM_IS_FULL
163		ERROR_PO_I2C_WRITE_ORDER
164		ERROR_PO_NO_TIMECLIENT_AVAILABLE
165		ERROR_PO_ORDER_IS_BUSY
166		ERROR_PO_ORDER_IS_FULL
167		ERROR_PO_PRODUCTION_READ_WRONG_TYPE
168		ERROR_PO_EEP1_EEP2_ARE_DIFFERENT
169		ERROR_PO_CRC_EEP1_ERROR
16A		ERROR_PO_CRC_EEP2_ERROR
16B		ERROR_PO_ORDER_HAS_FAILED
16C		ERROR_PO_NOT_AVAILABLE
16D		ERROR_PO_CRC_EEP1_EEP2_ERROR
180		ERROR_I2C_QUEUE_FULL
181		I2C_ERROR_ORDER_NOT_FOUND
182		I2C_ERROR_ORDER_TOO_BIG
183		I2C_ERROR_ORDER_BUSY
184		I2C-Bus : No order in I2C queue
185		I2C-Bus : No active order in I2C queue
186		I2C_ERROR_TOO_MANY_SOP
187		I2C_bad_SDA
188		I2C_bad_SCL
189		I2C_busy
18A		I2C_no_Acknowledge
18B		No Acknowledge from device
18C		I2C_ERROR_NO_ACK_FROM_START
18D		I2C_ERROR_NO_ACK_FROM_STOP
18E		I2C_ERROR_NO_ACK_FROM_SEND1
18F		I2C_ERROR_NO_ACK_FROM_SEND2
190		2C_ERROR_NO_ACK_FROM_RECEIVE

Error ID	Limits	Description
191		ERROR_I2C_SYNCHRONOUS_ORDER_TIMEOUT
192		ERROR_I2C_ASYNCHRONOUS_ORDER_TIMEOUT
193		ERROR_I2C_ORDER_HAS_FAILED
201		ERROR_DS_USER_BREAK
202		Drive system : Timeout during speed up - hand-spin only! speed does not settle after start command
203		ERROR_DS_SPEED_NOT_REACHED
204		Drive system : Speed slows down during measuring - speed falls below limit while measuring
205		Drive system : Wheel speeds up in reverse turn - Hand-spin only! main shaft rotating backwards on start command
206		Drive system : No acceleration during speed up or braking detected 1. Motor 2. Belt mounted? 3. Incremental encoder main shaft
207		Drive system : Slip detected (speed up to fast) 1. Wheel not clamped strong enough 2. no wheel or wheel mass to low
208		Drive system : Speed limit exceeded - speed exceeds security limit (mainly wheel guard open and drive management set to high speed)
210		Drive system : Clamping device got stuck in clamped position
211		Drive system : Clamping device got stuck in unclamped position
212		Drive system : Displacement limit exceeded during (un)clamping
213		Drive system : Belt disc rotates backward after clamping.
214		Drive system : Main shaft rotates during clamping (e.g. EMB defective?)
215		Drive system : Clamp device is locked
216		Drive system : Time limit for clamping process exceeded
300		Motor over-current detected by hardware. Over-current-LED on the power interface board will be cleared on the next activation of the motor
350	0.05 V	First Potentiometer : Voltage below measuring range (AD value : 0..10)
351	4.45 V	First Potentiometer : Voltage above measuring range (AD value : 1014..1024)
360	0.05 V	Second Potentiometer : Voltage below measuring range (AD value : 0..10) 361
361	4.45 V	Second Potentiometer : Voltage above measuring range (AD value : 1014..1024)
370	0.05 V	Third Potentiometer : Voltage below measuring range (AD value : 0..10)
371	4.45 V	Third Potentiometer : Voltage above measuring range (AD value : 1014..1024)
380	4.50 V	ASS : Voltage magnet below limit - off state.
381	1.00 V	ASS : Operating Voltage magnet below limit - on state.
382	2.00 V	ASS : Operating voltage magnet above limit - on state.
383	0.5 s	ASS : Operating Voltage magnet recharging time above limit
400		During measuring run : Data conditioning can't get proper speed information.
401		During measuring run : User break. (Measuring run stopped by user)
402		During measuring run : Temperature information invalid, 20°C used instead.
403		During measuring run : Can't perform transducer correction.
405		Channel 1 - channel 2 Phase shift too big

Error ID	Limits	Description
410		Transducer 1, No signal
411		Transducer 1, transimpedance to low
412		Transducer 1, RC time constant out of range
415		Transducer 1, transimpedance amplifier; idle voltage out of range
416		Transducer 1, DC amplifier; idle voltage out of range
418		Transducer 1, amplifier saturation
419		Transducer 1, Transfer function out of range
420		Transducer 2, No signal
421		Transducer 2, transimpedance to low
422		Transducer 2, RC time constant out of range
425		Transducer 2, transimpedance amplifier; idle voltage out of range
426		Transducer 2, DC amplifier; idle voltage out of range
428		Transducer 2, amplifier saturation
429		Transducer 2, Transfer function out of range
430		Transducer 1&2, No signal
431		Transducer 1&2, transimpedance to low
432		Transducer 1&2, RC time constant out of range
435		Transducer 1&2, transimpedance amplifier; idle voltage out of range
436		Transducer 1&2, DC amplifier; idle voltage out of range
438		Transducer 1&2, amplifier saturation
439		Transducer 1&2, Transfer function out of range
500		BL_BAL_ERROR_NoConverge
501		BL_BAL_ERROR_ResultInvalid
502		BL_BAL_ERROR_TooMuchLoops
510		BL_BAL_ERROR_NoCalUser
511		BL_BAL_ERROR_FailCalUser
512		BL_BAL_ERROR_SideCalUser
		NOTE: C1 = FRONT TRANSDUCER
560		c1 value too low, if a user calibration tool assumed ***C2 = REAR TRANSDUCER***
561		c2 value too low, if a user calibration tool assumed
565		c1 value too low, if a 100g weight and calibration rotor assumed
566		c2 value too low, if a 100g weight and calibration rotor assumed
570		c1 value too high, if a calibration rotor only assumed
571		c2 value too high, if a calibration rotor only assumed
580	-30°C	Temperature below -30°C or hardware fault.
581	100°C	Temperature above 100°C or hardware fault.
585	0.23 V	Temperature Input near to ground Voltage.
586	4.05 V	Temperature Input near to reference Voltage.
601		Internal error : To many event sinks
602		Internal error : Cannot register event sink
603		Internal error : Invalid event level
701		ERROR_IEMS_INV_PARAM
702		Incremental encoder not initialised. Software is not able to detect the reference mark.
703		Incremental encoder : Counter - reference mark mismatch
705	2.50 V	Opto electronic, No voltage on shunt resistor
706	4.30 V	Opto electronic, VCC on shunt resistor
707	16 mA	Opto electronic, Current through LED below limit
708	20 mA	Opto electronic, Current through LED above limit

Error ID	Limits	Description
710		Hand-spin with electromagnetic released brake - main shaft rotates backwards
800	170 V	Line voltage below limit
801	265 V	Line voltage above limit
804	275 V	Line voltage much too high
810	5.10 V	VCC below limit
811	5.35 V	VCC above limit
820	5.00 V	Keyboard/display voltage below limit
821	5.35 V	Keyboard/display voltage above limit
830	4.50 V	External voltage (pedal) below limit, see keyboard module
831		External voltage (pedal) above limit, see keyboard module
900		Power fail detected
9FF		ERROR_SELFTEST
e01		ASA: Status of an activated order has changed due to network manager or shop management software activities.

H CODES SYSTEM IV

H#	Internal code(s)	Description
H0		Wheel running conditions cannot be improved by optimisation
H1		Further optimisation not recommended but feasible
H2		Weight minimisation is recommended, optimisation can achieve no further improvement
H20		The correction plane cannot be re-located using the gauge arm
H21		Indexing position does not match correction plane
H22	0x492215	Unclamping of power clamp device is disabled
H26		The gauge arm was pulled out too quickly (normal operation, ASS calibration)
H28		NEW : The gauge arm was pulled out too slowly (ASS calibration)
H80	0x810510	No provision was made for readjustment
H82		Self test disturbed during execution
H90	0x492203	- Acceleration during start or stop too slow - Measuring speed not reached
H91	0x492204	Speed variations during measuring run

E CODES SYSTEM IV

E#	Internal code(s)	Description
E1		Rim dimensions entered incorrectly
E2		Wheel guard is not closed
E3		Gauge arm not in home position
E4		Outer gauge arm not in home position
E5		Range of electrical unbalance compensation exceeded (residual adapter unbalance)
E6	0x812560, 0x812561, 0x812565, 0x812566	Calibration weight not attached to flange
E7		No balancing mode for this wheel type
E8		Valve position was not entered
E9		Optimisation was carried out incorrectly

E	Internal code(s)	Description
E10		Wheel guard is not open, wheel may not be clamped / unclamped
E12	Not available to date	Pedal is operated, measuring run not possible
E13	Not available to date	The clearance of the solenoid brake is too wide.
E14		The power clamping device is not clamped
E15		Corrective terms for readjustment are out of range
E16	0x812570, 0x812571	Calibration weight attached erroneously to flange
E17	0x492207	Wheel slipped on adapter
E28	0x492205	Wrong direction of rotation (hand spin)
E29		Speed too high (hand spin ?)
E83		Vibration of the machine disturbed the unbalance measurement
E85		Power clamp service interval expired
E88	0x492208	The rotating speed of the main shaft exceeds the safety limit
E89		Key contact or pedal switch closed
E92	0x441350, 0x441351, 0x441360, 0x441361	The inner gauge arm for distance and rim diameter is defective
E93	0x441370, 0x441371	The outer gauge arm for rim width is defective
E101	0xC30E01	ASA: Status of an activeted order has changed due to network manager or shop management software activities.
E141	0x000169	Check sum of EEPROM 1 is wrong
E144	0x00016D	Check sums of both EEPROMs are wrong
E145	0x000168	Contents of the EEPROMs are different
E341	0x00016A	Check sum of EEPROM 2 is wrong
E812		The drive pulley was not readjusted by 180º relative to the main shaft
E900		No model selected
E901		Machine not calibrated
E990		Internal error (message server : message buffer overflow(1)) Machine halts.
E991		Internal error (message buffer overflow(2)) Machine halts.
E992		Internal error (synchronous receive time-out) Machine halts.

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